SAMSUNG
ELECTRONICS

LEAD-FREE

TO

DATE   : Feb. 1 , 2012

SAMSUNG TFT-LCD
MODEL NO. : LTN133AT23-0

NOTE : Extension code [- 0**   ]
              → LTN133AT23-0**
          Surface type [**Anti-Glare**]

Any modification of Spec is not allowed without SEC's permission

APPROVED BY : _____

PREPARED BY :   *Khan Kim*   _____

Application Engineer Group
SAMSUNG ELECTRONICS CO., LTD.

CONTENTS

REVISION HISTORY

Date	Revision No.	Page	Summary
Nov. 15, 2011	A00	All	The Approval specification of LTN133AT23-0 was issued first.
Feb. 1, 2012	A01	P.14	Pin number was wrong(#20, #21) → Modified

CODE REVISION HISTORY

Date	Model.	Revision No.	Summary

Doc.No.	LTN133AT23-0	Rev.No	04-A01-G-120201	Page	3 / 38

GENERAL DESCRIPTION

DESCRIPTION

LTN133AT23 is a color active matrix TFT (Thin Film Transistor) liquid crystal display
(LCD) that uses amorphous silicon TFT as switching devices.
This model is composed of a TFT LCD panel, a driver circuit and a backlight unit.
The resolution of a 13.3" contains 1366 x 768 pixels and can display up to 262,144 colors.
6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio
- HD(1366 x 768 pixels) resolution
- Fast Response
- LED Back Light with embedded LED Driver
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	293.4168 (H) x 164.9664 (V) (13.3"diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1366 * 768	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2148(H) x 0.2148(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25%		Anti Glare

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	307.5	308.0	308.5	mm	
	Vertical (V)	183.0	183.5	184.0	mm	
	Depth (D)	-	-	4.0	mm	With PCB area
Weight		-	310	325	g	

Note (1) Measurement condition of outline dimension
　　　　　. Equipment : Bernier Calipers
　　　　　. Push Force : 750 $\pm$ 250 g ·f

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
　　　　95 % RH Max. (40 °C > Ta)
　　　　Maximum wet - bulb temperature at 39 C or less. (Ta $\geq$ 40 °C) No condensation

Relative Humidity (%RH)
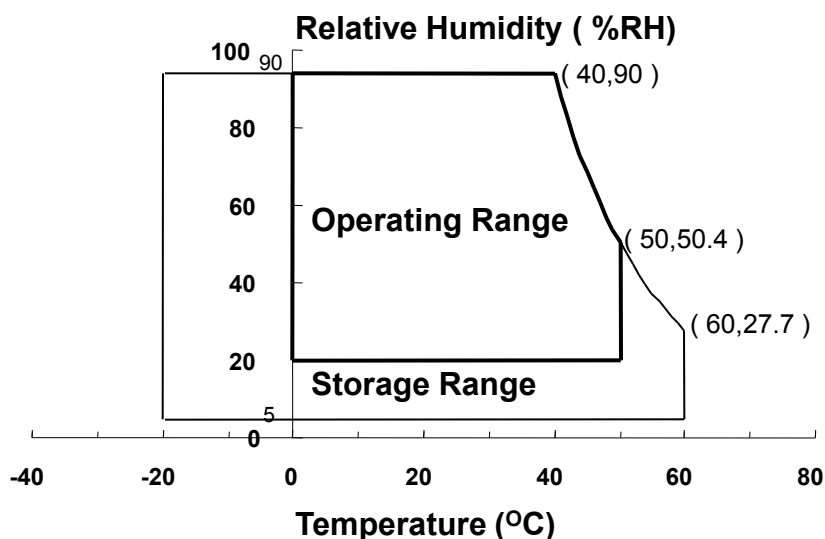
(2) 2ms, half sine wave, one time for $\pm$X, $\pm$Y, $\pm$ Z.
(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{DD} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	V_{DD} - 0.3	V_{DD} + 0.3	V	(1)
Logic Input Voltage	V_{IN}	V_{DD} - 0.3	V_{DD} + 0.3	V	(1)

Note (1) Within Ta (25 ± 2 °C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Current	I_L	-	24	-	mArms	(1)
LED Voltage	V_L	-	3.2	-	V	(1)

Note 1) Permanent damage to the device may occur if maximum values are exceeded
Functional operation should be restricted to the conditions described under normal operating conditions.

2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5). Measuring equipment : TOPCON SR-3

* Ta = 25 ± 2 °C, V$_{DD}$=3.3V, fv= 60Hz, f$_{DCLK}$ = 70.7MHz, IF = 100% duty

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR		300	-	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T$_{RT}$		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		Y$_{L,AVE}$		200	220	-	cd/m^2	IF=100% duty (1), (4)
Color Chromaticity (CIE)	Red	R$_X$	Normal Viewing Angle $\phi = 0$ $\theta = 0$	Typ-0.03	0.560	Typ +0.03	-	(1), (5) SR-3
		R$_Y$			0.340			
	Green	G$_X$			0.335			
		G$_Y$			0.565			
	Blue	B$_X$			0.160			
		B$_Y$			0.120			
	White	W$_X$			0.313			
		W$_Y$			0.329			
Viewing Angle	Hor.	θ_L	CR $\geq$ 10 At center	30	45	-	Degrees	
		θ_H		30	45	-		
	Ver.	ϕ_H		10	15	-		
		ϕ_L		20	30	-		
Color Gamut		CG		-	45	-	%	
13 Points White Variation		δ_L		-	1.7	2.0	-	(6)

Note 1) Definition of Viewing Angle : Viewing angle range(10 ≤ C/R)

Normal Line
$\phi = 0^o, \theta = 0^o$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90^o$ x

12 O'clock direction
$\phi_H = 90^o$

y

6 O'clock direction
$\phi_L = 90^o$ y'

x'

$\theta_R = 90^o$
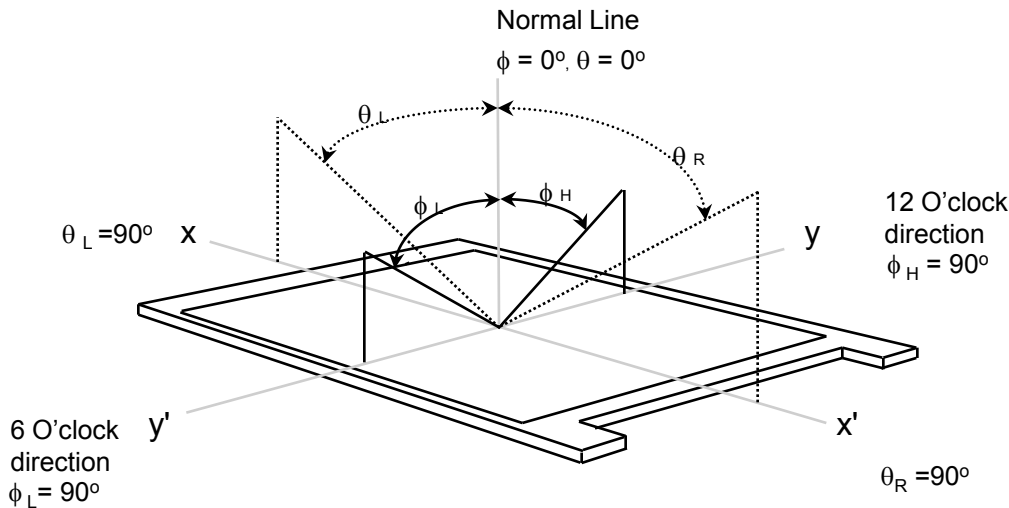
Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin)
at 5 points(4, 5, 7, 9, 10)

$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : ④ , ⑤ , ⑦ , ⑨ , ⑩ at the figure of Note (6).

Note 3) Definition of Response time :

Display data   White(TFT OFF)   Black(TFT ON)   White(TFT OFF)

T_R T_F

Optical Response

100%
90%

10%
0%

Time
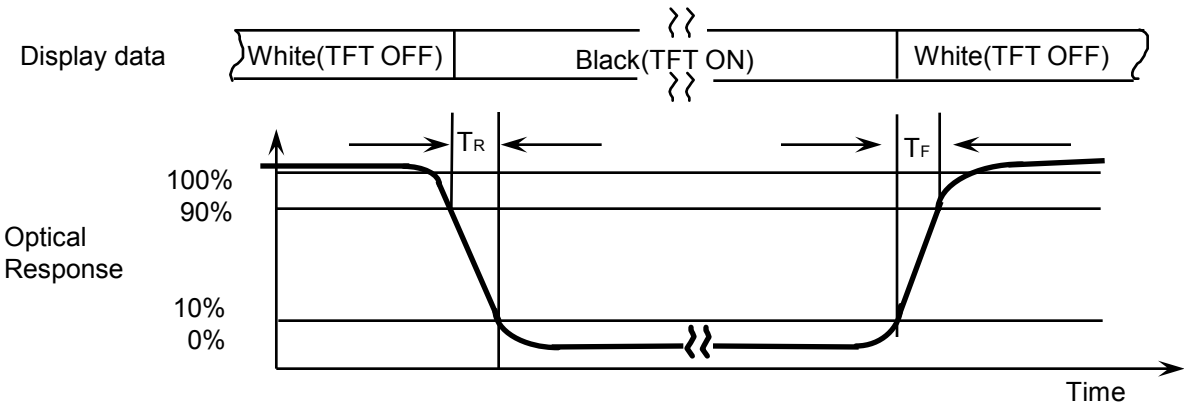
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

25%   50%   75%

VIEW AREA

⑩   ⑨   25%

⑦   50%

⑤   ④   75%
(lines)

○ : test point

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| Doc.No. | LTN133AT23-0 | Rev.No | 04-A01-G-120201 | Page | 8 / 38 |
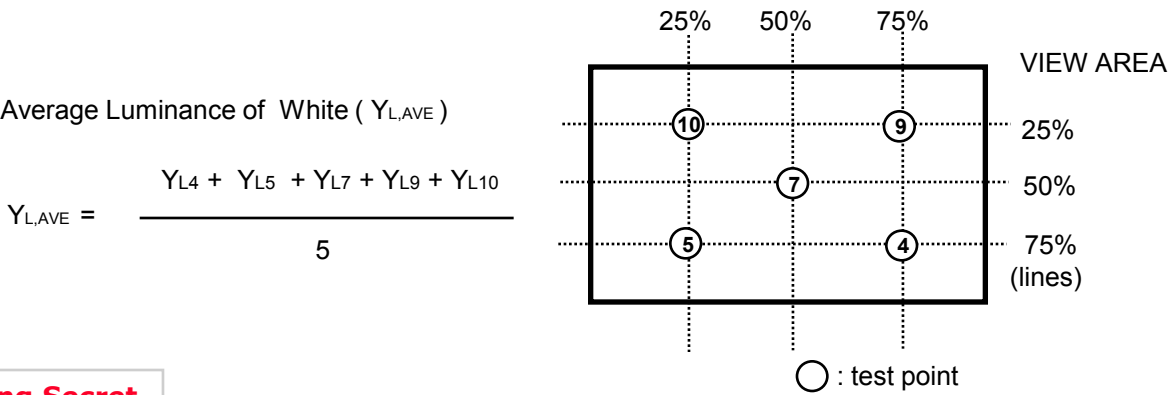
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
IF current : 24mA
Environment condition : Ta = 25 $\pm$ 2 °C

Photo-detector
(TOPCON SR-3)

Field = 2°

50 cm

TFT-LCD module

LCD panel
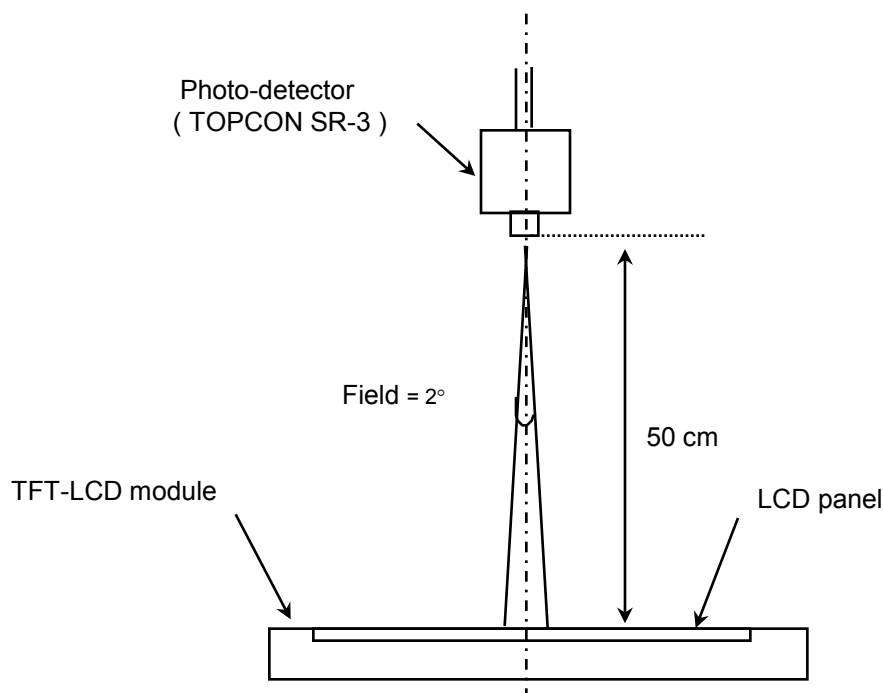
Note 6) Definition of 13 points white variation (δ L), CR variation(C$_{VER}$) [① ~ ⑬]

$$\delta L \ = \ \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$

10mm   25%   50%   75%   **10mm**

10mm

13   12   11

10   9   25%

8   7   6   50%   ◯ : test point

5   4   75%

3   2   1

10mm

| **Doc.No.** | LTN133AT23-0 | **Rev.No** | 04-A01-G-120201 | **Page** | 9 / 38 |
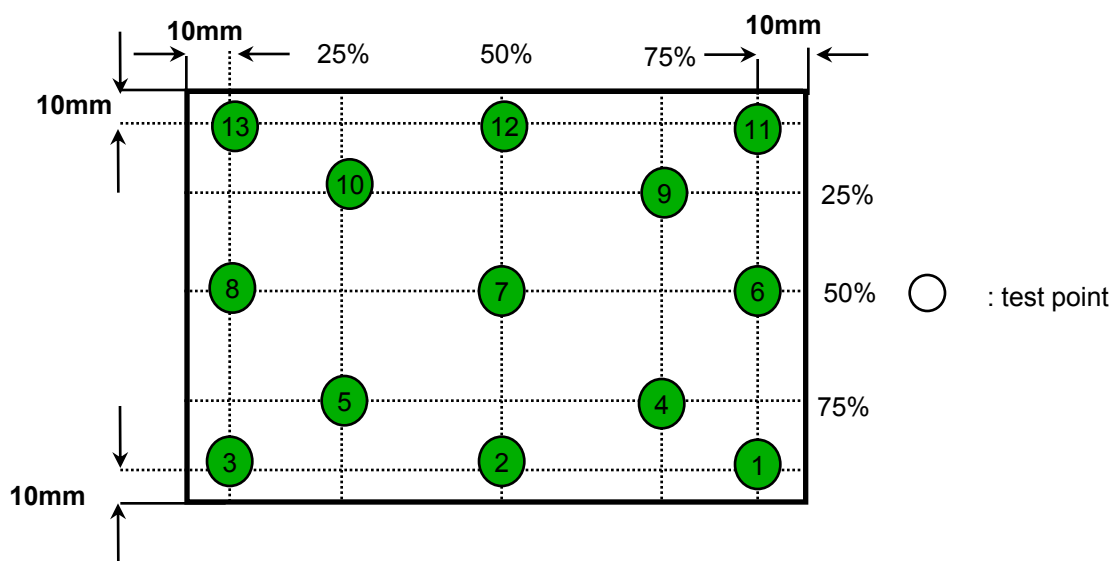
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= $25 \pm 2°C$

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V_{IH}	-	-	+100	mV	V_{CM} = +1.2V
	Low	V_{IL}	-100	-	-	mV	
Vsync Frequency		fv	-	60	-	Hz	
Main Frequency		f_{DCLK}	-	70.7	-	MHz	-
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	IDD	-	230	-	mA	*a),b),c)
	Mosaic		-	210	254	mA	
	V.stripe		-	300	-	mA	

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

(2) fv = 60Hz, f = 70.7MHZ, V = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern

*b) Mosaic Pattern

VIEW AREA

Display Brightest Gray Level ⟶

Display Darkest Gray Level ⟶
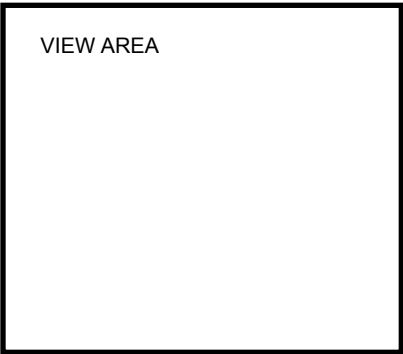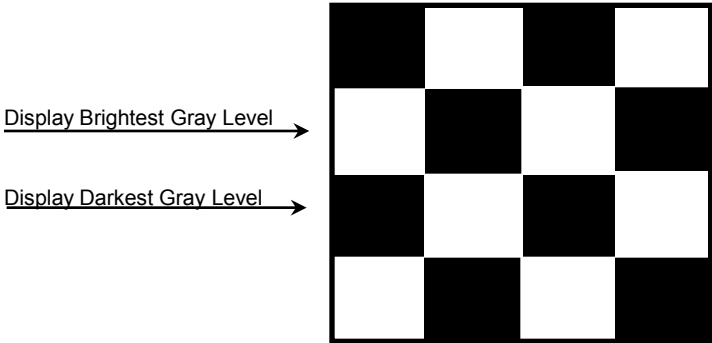
*c) 1dot Vertical stripe pattern

R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
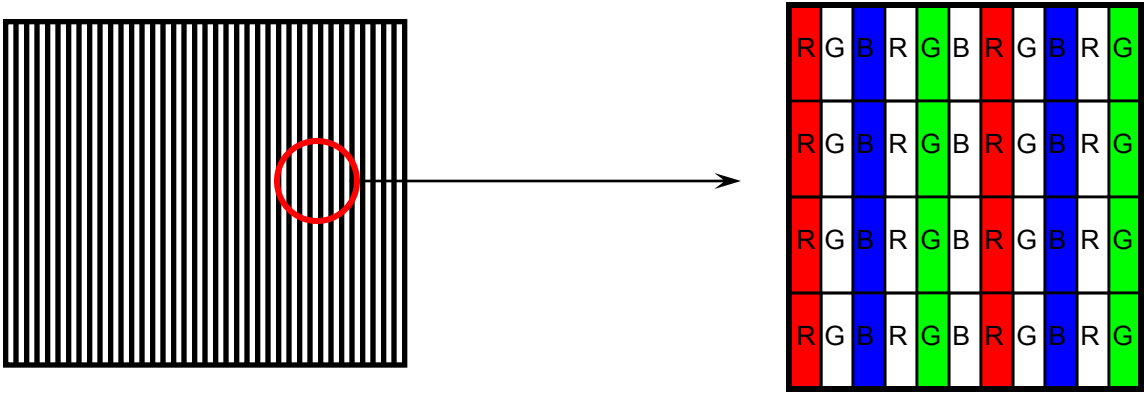
4) Rush current measurement condition

V_{DD} rising time is 470us

Doc.No.	LTN133AT23-0	Rev.No	04-A01-G-120201	Page	11 / 38
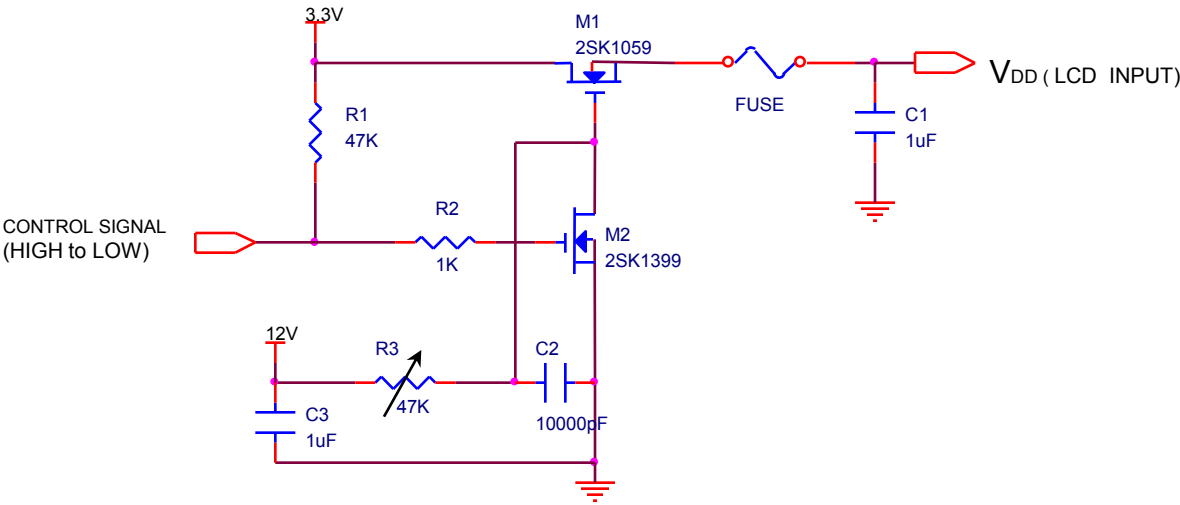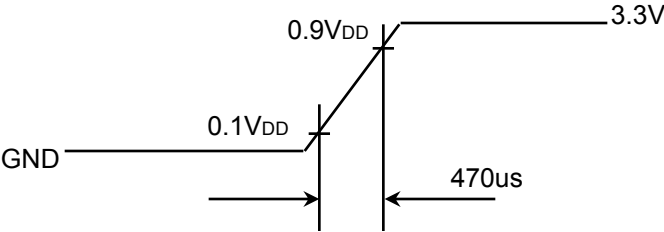
3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	24	-	mA	
LED Forward Voltage	VF	-	3.2	-	V	
LED Array Voltage	VP	-	25.6	-	V	VF X 8LEDs
BL consumption	P	-	-	0.8	W	@ 60 nit
		-	3.4	3.8	W	@ Max

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the
condition Ta= 25 ± 2 °C and IF = 24mArms until one of the following event occurs.
When the brightness becomes 50% or lower than the original.

3.3 LED Driver

- On board LED Driver (RICHTEK)

Ta= 25 ± 2 °C

Item-	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{in}	7	12	24	V	-
Input Current	I	-	280	316	mA	-
EN control level	ON	2	3.3	5.0	V	
	OFF	0	0	0.5	V	
PWM control level	ON	2	3.3	5.0	V	
	OFF	0	0	0.5	V	
PWM Control Duty Ratio	D	5	-	100	%	
External PWM Dimming Control Frequency (BLIM)	F_{BLIM}	0.12	1	30	kHz	
Operating Life Time	Hr	15,000	-	-	Hour	

Note - Test Equipment : Fluke 45

4. BLOCK DIAGRAM

4.1 TFT LCD Module

Legend:
- → Gamma
- → PVDD
- → AVDD
- → Von/Voff
- → DVDD
- → VLED & FB
- → Data Signal
- → Control Signal
- → VCOM
- → Gate IC Signal
- → VBL

SOURCE PCB

Panel: 13.3" HD TFT-LCD Panel (1366*768)
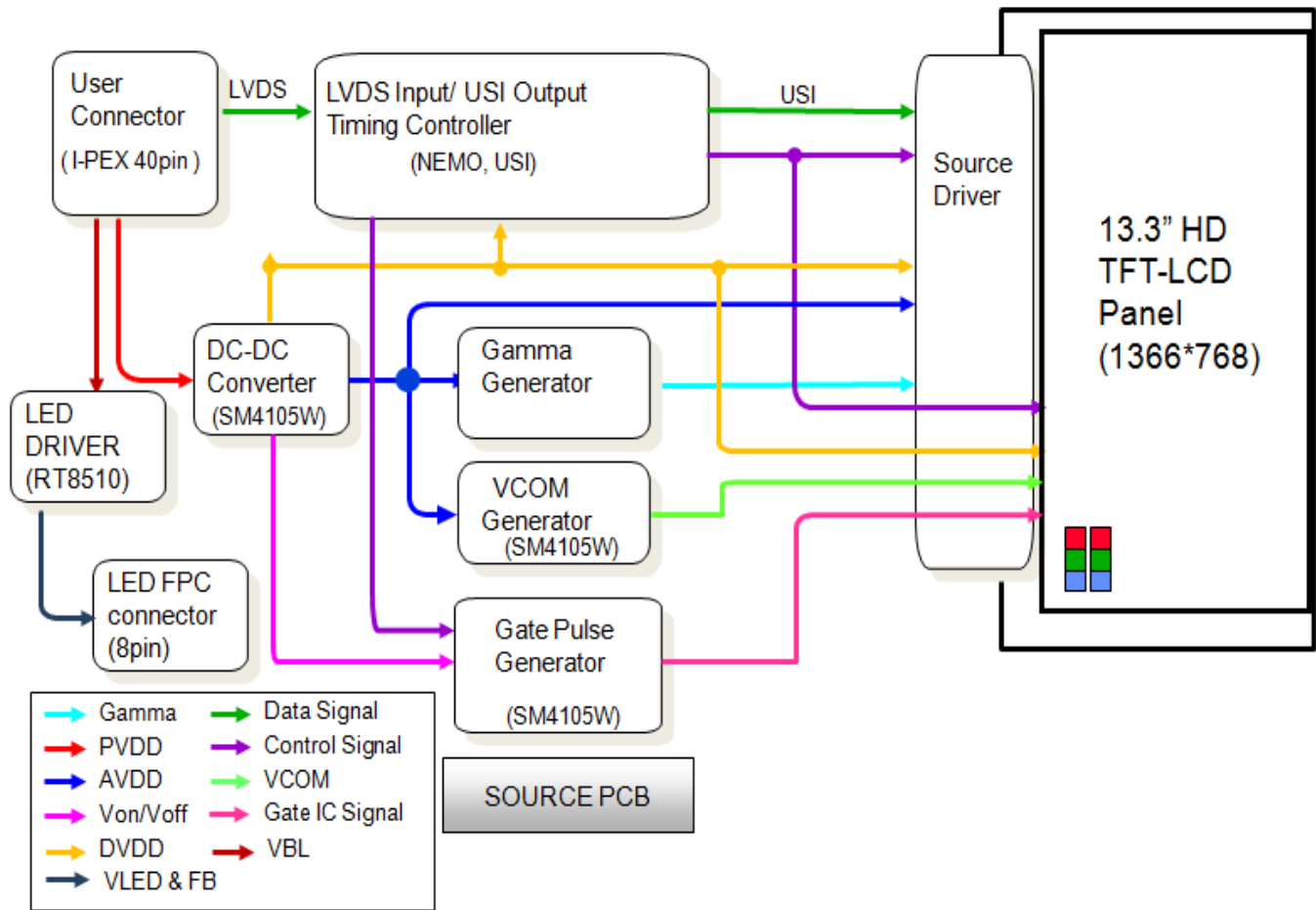
4.2 LED placement structure

Anode — D1 D2 D3 D4 D5 D6 D7 D8 — Cathode
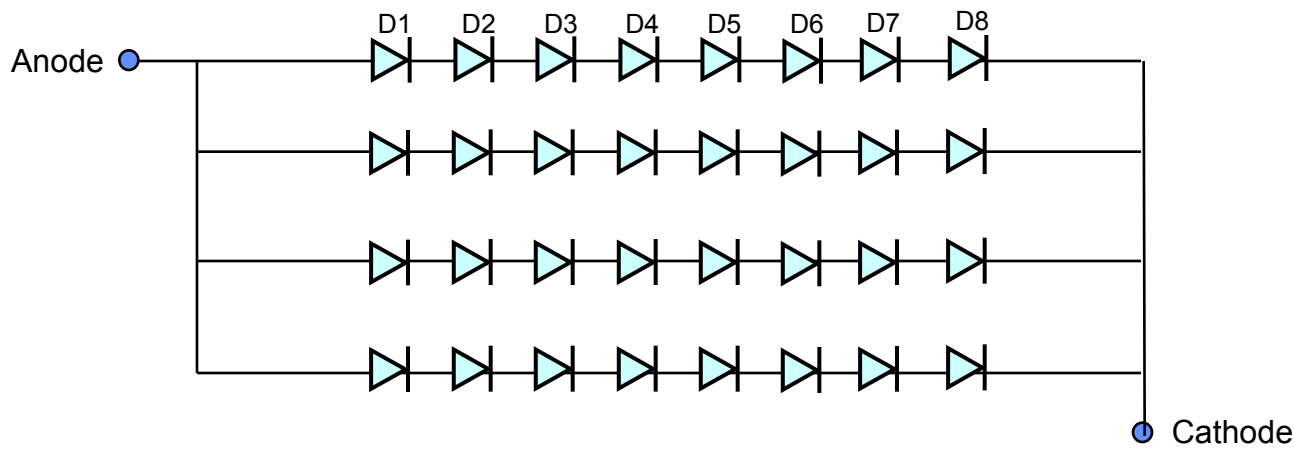
5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E-## or equivalent)

No.	Symbol	Function	Polarity	Remarks
1	NC	No Connection (Reserved for supplier)		
2	AVDD	Power Supply 3.3V (typical)		
3	AVDD	Power Supply 3.3V (typical)		
4	DVDD	DDC 3.3V power		
5	NC	No Connection (Reserved for supplier)		
6	SCL	DDC Clock		
7	SDA	DDC data		
8	RIN0-	-LVDS differential data input (R0-R5, G0)	Negative	
9	RIN0+	+LVDS differential data input (R0-R5, G0)	Positive	
10	GND	Ground		
11	RIN1-	-LVDS differential data input (G1-G5, B0-B1)	Negative	
12	RIN1+	+LVDS differential data input (G1-G5, B0-B1)	Positive	
13	GND	Ground		
14	RIN2-	-LVDS differential data input (B2-B5, HS, VS, DE)	Negative	
15	RIN2+			
16	GND	Ground		
17	CLK-	-LVDS differential clock input	Negative	
18	CLK+	+LVDS differential clock input	Positive	
19	GND	Ground (Reserved for supplier)		
20	NC	No connection		
21	NC	No connection		
22	GND	Ground		
23	NC	No connection		
24	NC	No connection		
25	GND	Ground		
26	NC	No connection		
27	NC	No connection		
28	GND	Ground		
29	NC	No Connect		
30	NC	No Connect		

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No.	Symbol	Function	Polarity	Remarks
31	VSSLED	Ground－LED		
32	VSSLED	Ground－LED		
33	VSSLED	Ground－LED		
34	NC	No Connect (Reserved for supplier)		
35	PWM	System PWM Signal Input (+3.3V Swing)		
36	BL_EN	Back Light enable pin (+3.3V Input)		
37	NC	No Connector		
38	VDDLED	7V－20V LED power		
39	VDDLED	7V－20V LED power		
40	VDDLED	7V－20V LED power		

5. 2 LVDS Interface

5.2.1 LVDS DC Input

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS Differential Voltage	Vid	200	200	400	mV	
Input Common Mode Voltage	V_{CM}	0.4	1.2	1.6	V	
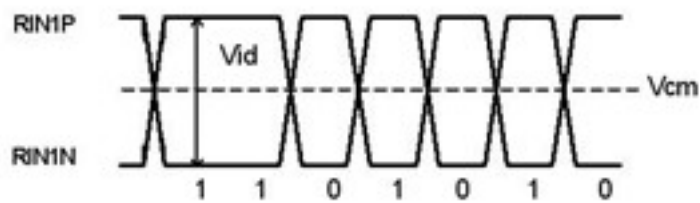
5.2.2 LVDS AC Input

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS input clock frequency		F_{CLK_LVDS}	20	-	100	MHz	
RIN skew margin	100 MHz	T_{RSRM}	-200	-	200	ps	(1),(2)
	50 MHz		-600	-	600	ps	(1),(2)
SSC Modulation Rate			-	-	±3	%	(3)
SSC Modulation Frequency			-	-	300	KHz	(3)

Note (1) : LVDS Receiver Skew (Strobe) Margin
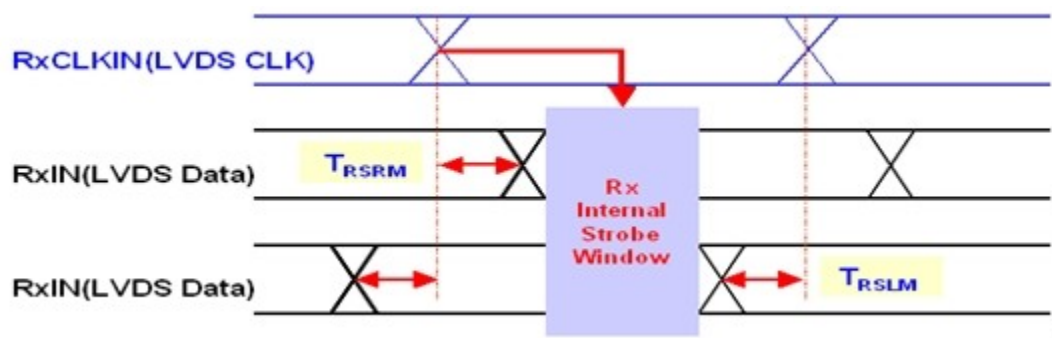
Note (2) : Ideal Strove Positions for LVDS Input
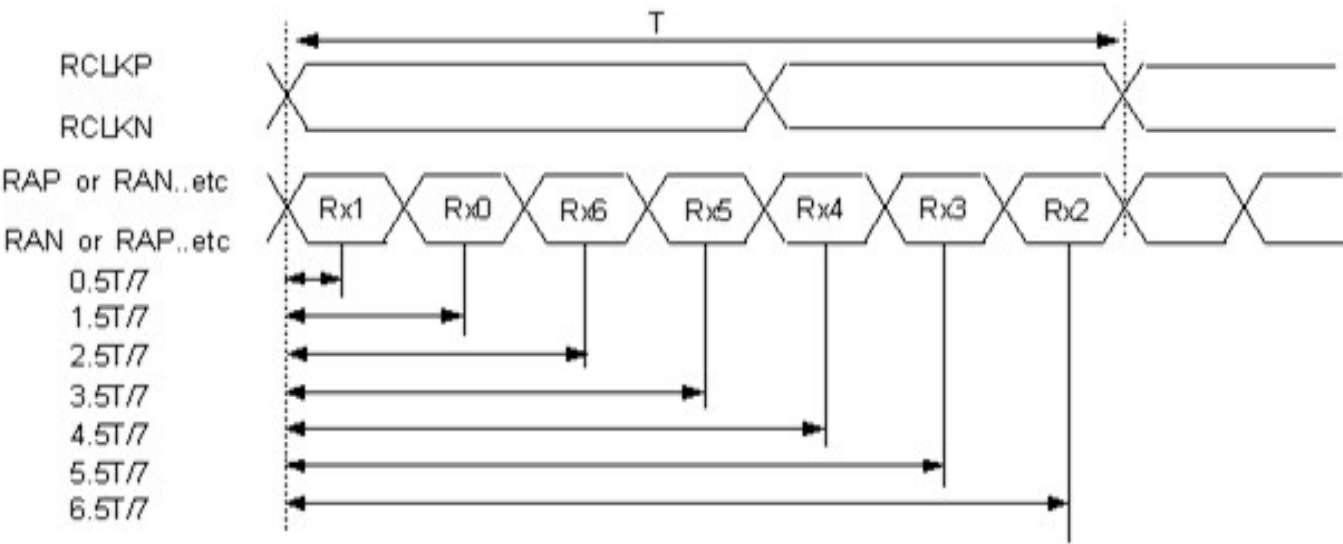
Note (3) : SSC (Spread Spectrum Clock)

5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-con

* 6Bit NS Format

Doc.No.	LTN133AT23-0	**Rev.No**	04-A01-G-120201	**Page**	18 / 38

5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

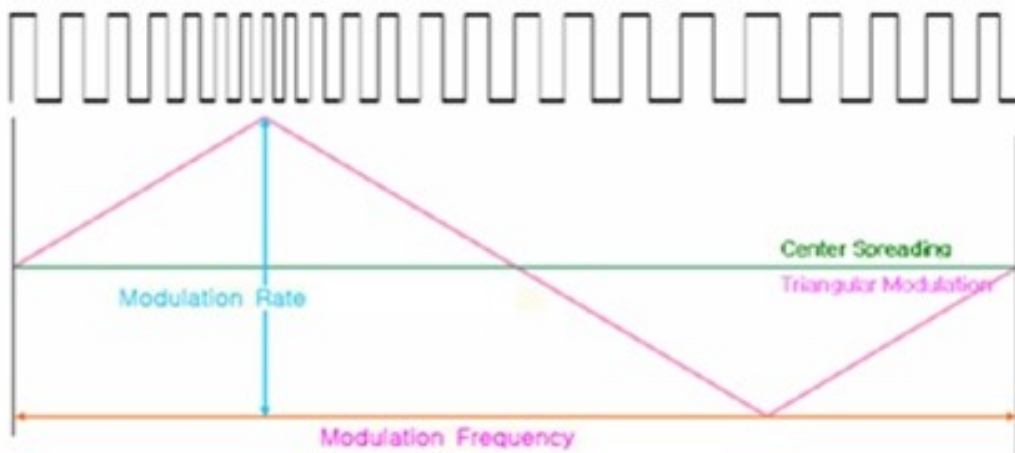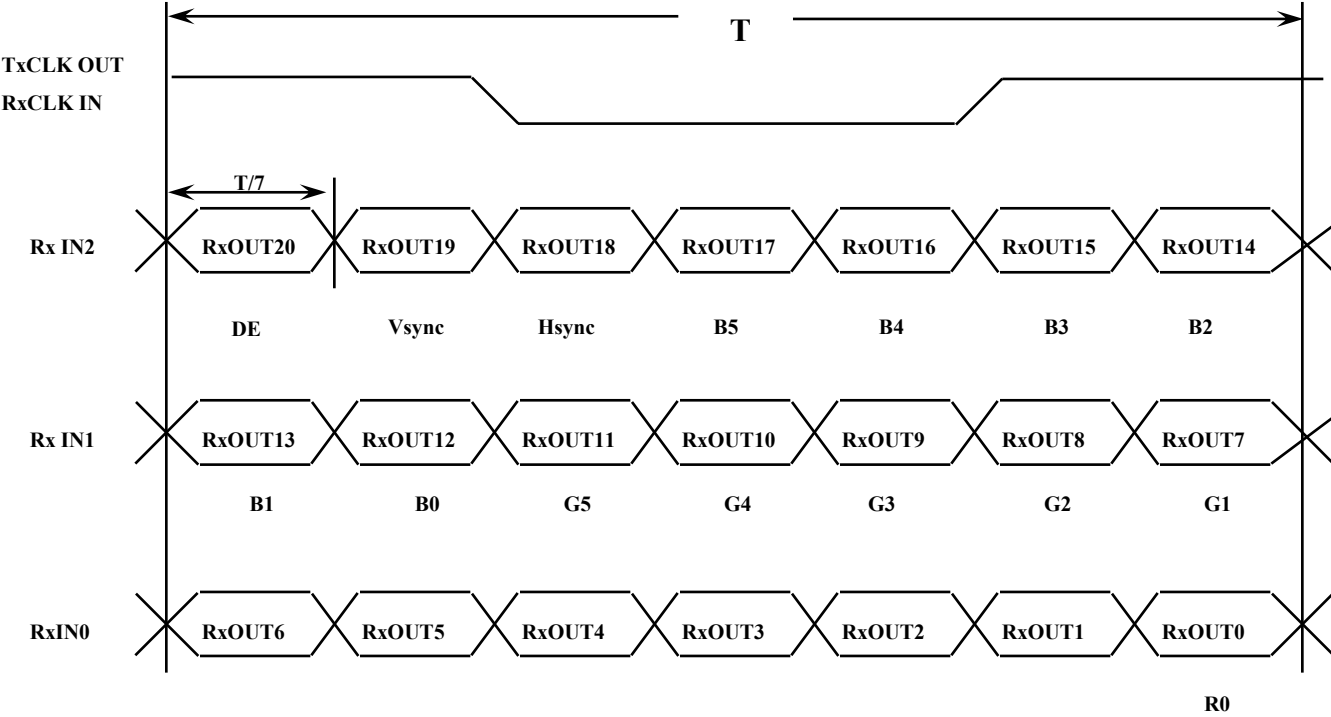| Color & Gray scale	Data Signal																	
	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Light blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Purple	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	^--v						^--v						^--v					
	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
↓	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	^--v						^--v						^--v					
	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
↓	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	^--v						^--v						^--v					
	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
↓	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note 1) Definition of gray :
     Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)
Note 2)Input signal: 0 =Low level voltage, 1=High level voltage

5.5 Pixel Format in the display

| | 1 | | | | | | | | | 1366 |

Line 1   R G B   R G B   R G B   R G B

LTN133AT23-0 Panel

Line 768   R G B   R G B   R G B   R G B

| **Doc.No.** | LTN133AT23-0 | **Rev.No** | 04-A01-G-120201 | **Page** | 20 / 38 |
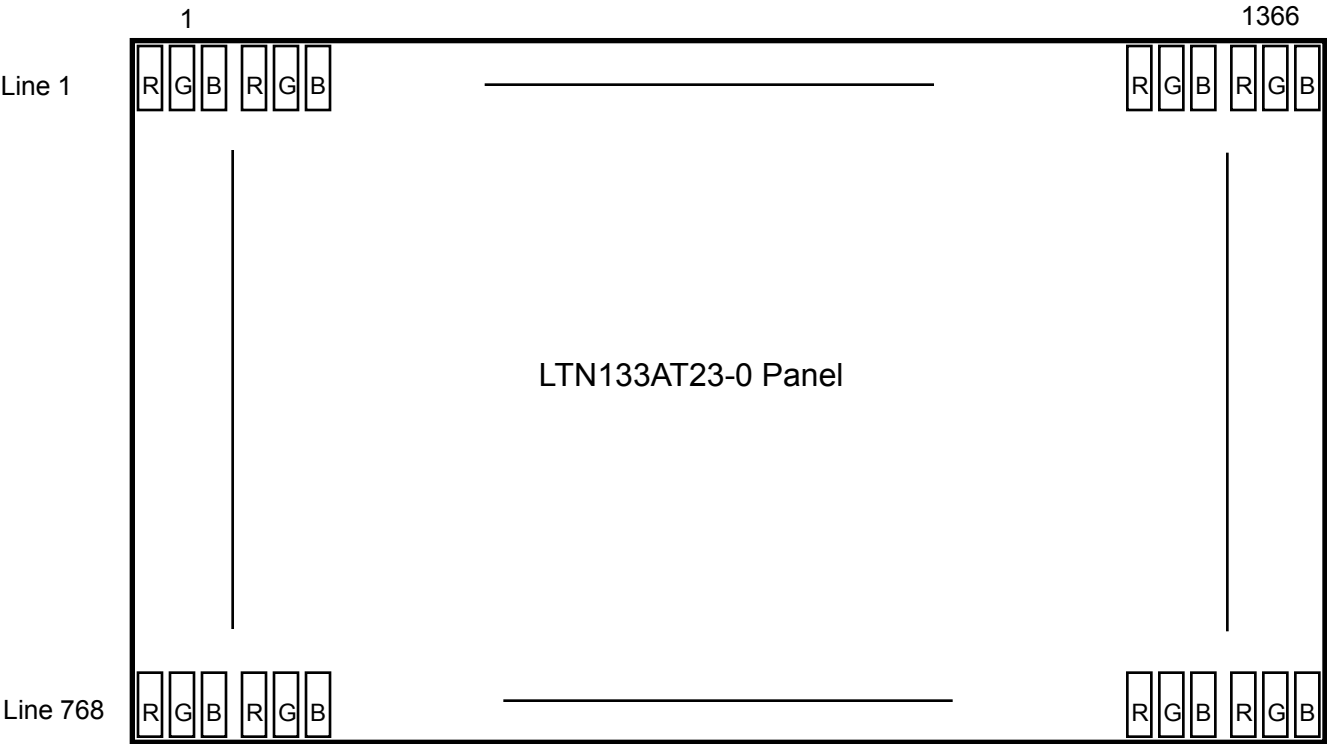
6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	778	780	868	Lines	
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	
One Line Scanning Time	Cycle	TH	1466	1500	1766	Clocks	
Horizontal Active Display Term	Display Period	THD	-	1366	-	Clocks	

6.2 Timing diagrams of interface signal
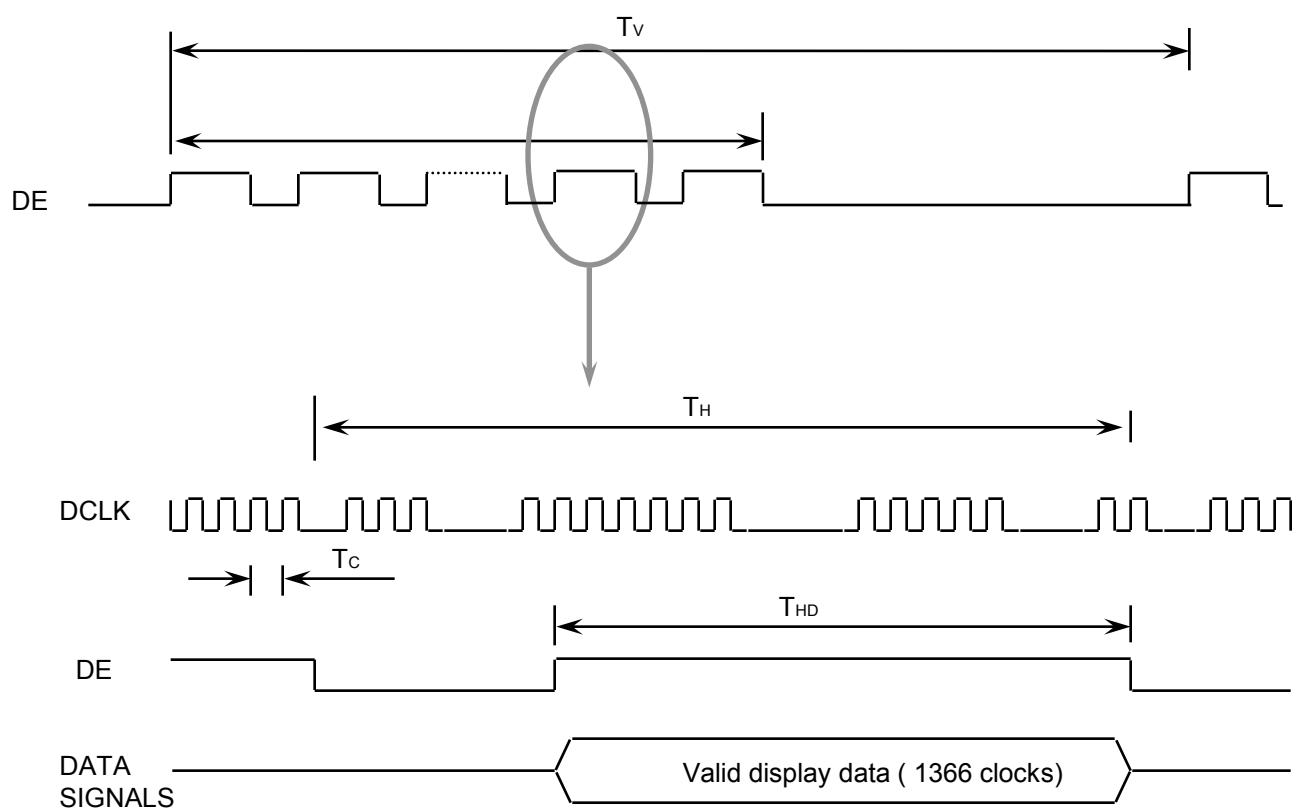
6.3 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.
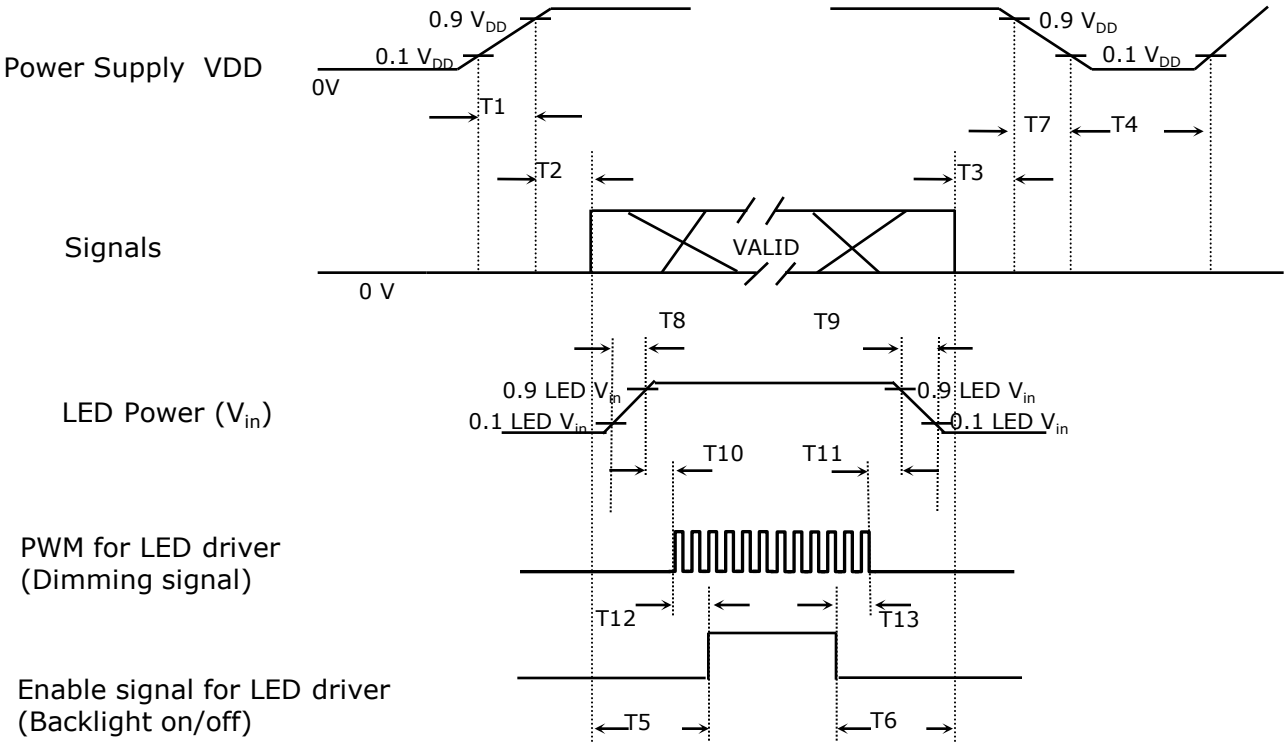
Timing (ms)	Remarks
$0.5 < T1 \leq 10$	V_{DD} rising time from 10% to 90%
$0 < T2 \leq 50$	Delay from V_{DD} to valid data at power ON
$0 < T3 \leq 50$	Delay from valid data OFF to V_{DD} OFF at power Off
$500 \leq T4$	V_{DD} OFF time for Windows restart
$200 \leq T5$	Delay from valid data to B/L enable at power ON
$200 \leq T6$	Delay from valid data off to B/L disable at power Off
$0 < T7 \leq 10$	V_{DD} falling time from 90% to 10%
$0.5 < T8 \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T9 \leq 10$	LED V_{in} falling time from 90% to 10%
$0 \leq T10$	Delay from LED driver Vin rising time 90% to PWM ON
$0 \leq T11$	Delay from PWM Off to LED driver Vin falling time 10%, Must Keep rule
$0 \leq T12$	Delay from PWM ON to B/L Enable ON, Must Keep rule
$0 \leq T13$	Delay from B/L Enable Off to PWM Off

Power Sequence & Timing Parameters

Samsung Secret

7. Mechanical Outline Dimension

Refer to the next page

307.5±0.5[OUTLINE DIMENSION]
298.82(BEZEL OPEN)
293.4168(ACTIVE AREA)
279.26 ±0.3(HOLE TO HOLE)
(139.66)
8±0.2
∅2.4
8±0.2
R1.2
(146.7084)
(81.9832)
(90.79)
184.9664(ACTIVE AREA)
171.33(BEZEL OPEN)
183.0 [OUTLINE DIMENTION]
190.15 (HOLE TO HOLE)
8±0.2
∅2.4
(106.88)
8±0.2
2-R1.2
46.87
214.2

3.8Max
3.8 MAX
4.0 Max
4.0 MAX
65
14.3

LTN133AT23
XXXXXXXXXXX   C01
MADE IN CHINA

4.5±0.1
192.77

* NOTE

1. SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
   - PART NO./MAKER : I-PEX 20455-040E-02S / I-PEX

2. LED CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW
   - PART NO./MAKER : PF050-010B-C11/JJU

3. CALIPERS MEASURING FORCE : 750gf-cm

4. WEIGHT : 330g MAX

5. Inorder to avoid IC damage, it is not allow
   that overlapping of cables or antennas, camera, WLAN,
   WWAN over these COF location

| REV	DATE	DESCRIPTION OF REVISION	REASON	CHG'D BY		
UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTN133AT23-C01
SCALE	1/1		C.J.PARK				
GENERAL TOLERANCE ±0.5			2010.11.22			PART/SHEET NAME	OUTLINE DIMENSION	SHEET 1/1
					SPEC. NO.		
SAMSUNG ELECTRONICS						CODE NO.		VER. 000

8. PACKING

1. CARTON (Internal Package)

   (1) Packing Form
     Corrugated fiberboard box and corrupad form as shock absorber

   (2) Packing Method

Packing Pallet Box

Cushion Top

Panel

Cushion Bottom
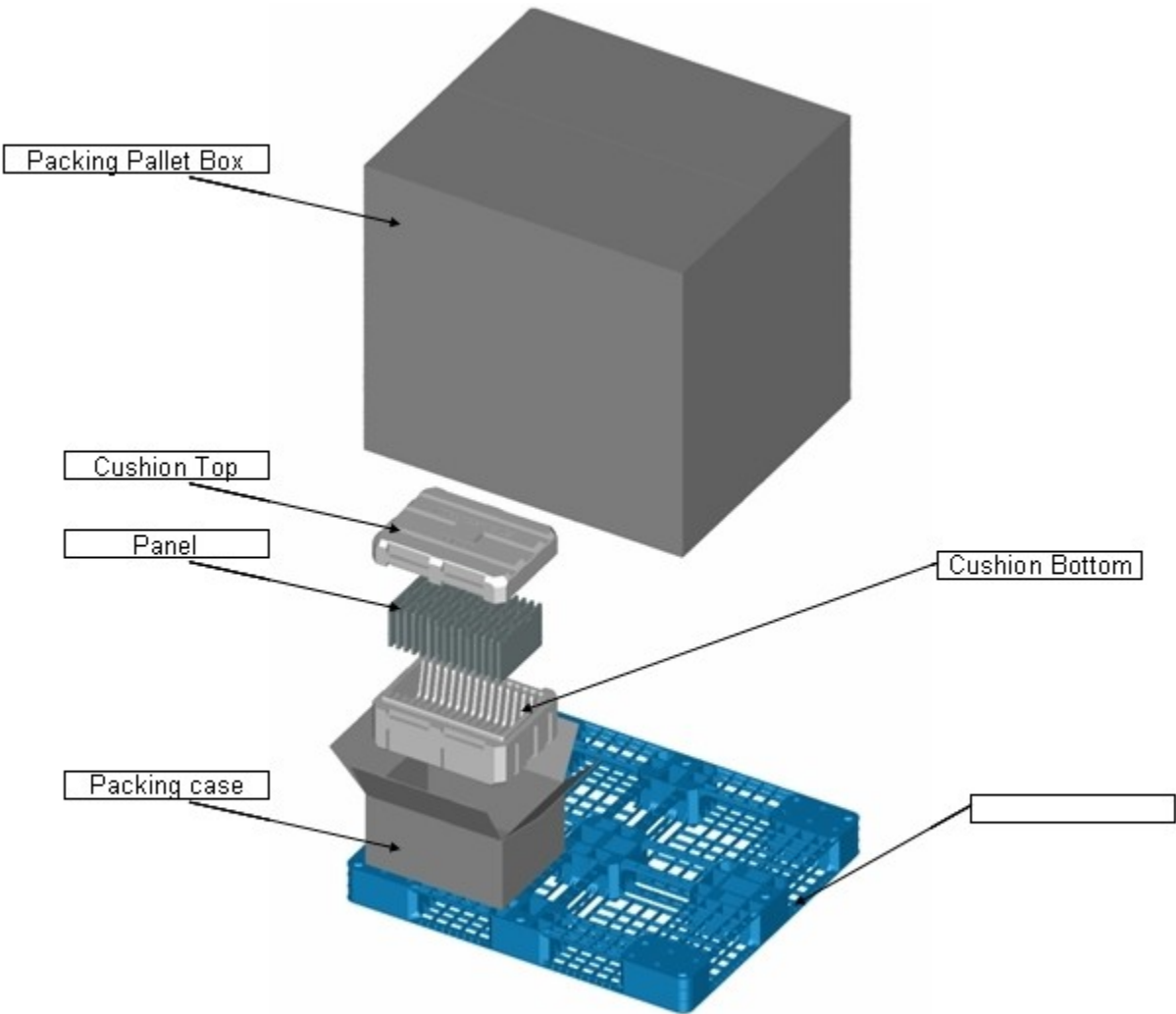
Packing case

PACKING CASE

Note 1)Total Weight : Approximately 7.0 kg
     2) Acceptance number of piling : 30 sets
     3) Carton size : 450(W) × 340(D) × 230(H)

(3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	30
2	Cushion pad(Inner box) included shock absorber	1 set
3	Silicagel (500x1)	10g*1EA
4	Pictorial marking	2 pcs
5	Carton	1 set

9. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTN133AT23-0
(2)Revision code : 3 letters
(3)Lot number   : X X X X XXX XX X   **0****

SEC Revision Code
Panel number
Cell ID
Lot ID
Month
Year
Product Code
Line
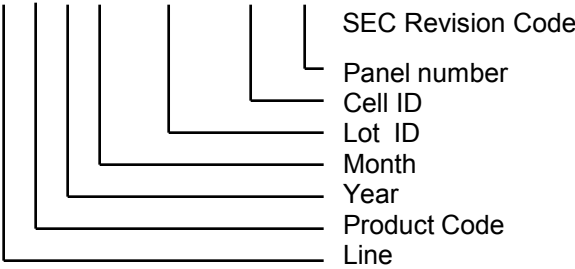
(4) Nameplate Indication
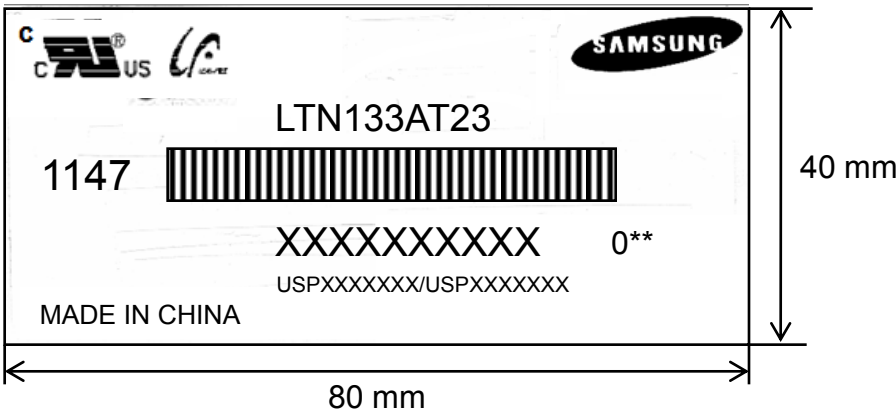
Parts name   : LTN133AT23
Lot number   : XXXXXXXXXX
USPXXXXXXX/USPXXXXXXX : USP Related information Num.
Inspected work week   : 1147(2011 year, 47th week)
Product revision Code : 0**

Doc.No.	LTN133AT23-0	Rev.No	04-A01-G-120201	Page	26 / 38

(5) Packing small box attach

SAMSUNG
ELECTRONICS

▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮

DEVICE   : LTN133AT23
TYPE   : 0**
QUANTITY   : 30 PCS

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

CO6040001

10. GENERAL PRECAUTIONS
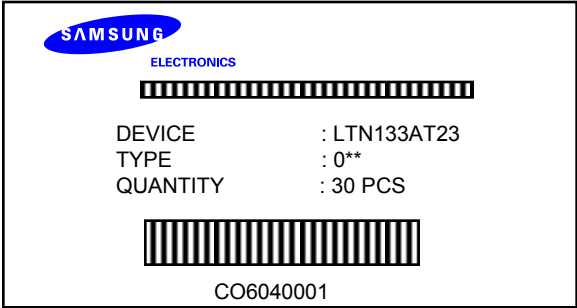
1. Handling

 (a) When the module is assembled, It should be attached to the system firmly
    using every mounting holes. Be careful not to twist and bend the modules.

 (b) Refrain from strong mechanical shock and / or any force to the module. In addition to
    damage, this may cause improper operation or damage to the module and LED back-light.

 (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch
    the surface harder than a HB pencil lead.

 (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time,
    Staining and discoloration may occur.

 (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

 (f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane.
    Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl
    chloride. It might permanent damage to the polarizer due to chemical reaction.

 (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or
    mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly
    with soap.

 (h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

 (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming
    inspection and assembly process.

 (j) Do not disassemble the module.

 (k) Do not pull or fold the lamp wire.

 (l) Do not adjust the variable resistor which is located on the back side.

 (m) Protection film for polarizer on the module shall be slowly peeled off just before use so
    that the electrostatic charge can be minimized.

 (n) Pins of I/F connector shall not be touched directly with bare hands.

2. STORAGE

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	-The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range. we recommend you leave the at a temperature of 20℃ and a humidity of 50% for 24 hours.		

3. OPERATION

(a) Do not connect, disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3
" Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

4. OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time,it can be the situation when the image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

| **Doc.No.** | LTN133AT23-0 | **Rev.No** | 04-A01-G-120201 | **Page** | 30 / 38 |

Appendix A. EDID

LTN133AT23-001(1366 *768) EDID Sheet

Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
00	Header	00	00000000	0		EDID Header
01		FF	11111111	255		
02		FF	11111111	255		
03		FF	11111111	255		
04		FF	11111111	255		
05		FF	11111111	255		
06		FF	11111111	255		
07		00	00000000	0		
08	ID Manufacturer Name	4C	01001100	76	S E C	3 character ID
09		A3	10100011	163		"SEC"
0A	ID Product Code	46	01000110	70	[F]	
0B		34	00110100	52	[4]	
0C	32-bit serial no.	00	00000000	0		
0D		00	00000000	0		
0E		00	00000000	0		
0F		00	00000000	0		
10	Week of manufacture	00	00000000	0		
11	Year of manufacture	15	00010101	21	2011	2011
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0
13	EDID revision #	03	00000011	3	3	EDID Rev. 3
14	Video input definition	80	10000000	128		
15	Max H image size	1D	00011101	29	29	29 cm(approx)
16	Max V image size	10	00010000	16	16	16 cm(approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	0A	00001010	10		
19	Red/green low bits	87	10000111	135		10000111
1A	Blue/white low bits	F5	11110101	245		11111110
1B	Red x/ high bits	94	10010100	148	0.580	Red x 0.580= 1001010010
1C	Red y	57	01010111	87	0.340	Red y 0.340= 0101011100
1D	Green x	4F	01001111	79	0.310	Green x 0.310= 0100111101
1E	Green y	8C	10001100	140	0.550	Green y 0.550= 1000110011
1F	Blue x	27	00100111	39	0.155	Blue x 0.155= 001001111
20	Blue y	27	00100111	39	0.155	Blue y 0.155= 001001111
21	White x	50	01010000	80	0.313	White x 0.313= 0101000001
22	White y	54	01010100	84	0.329	White y 0.329= 0101010001
23	Established timing 1	00	00000000	0		
24	Established timing 2	00	00000000	0		
25	Established timing 3	00	00000000	0		
26	Standard timing #1	01	00000001	1		not used
27		01	00000001	1		
28	Standard timing #2	01	00000001	1		not used
29		01	00000001	1		
2A	Standard timing #3	01	00000001	1		not used
2B		01	00000001	1		
2C	Standard timing #4	01	00000001	1		not used
2D		01	00000001	1		
2E	Standard timing #5	01	00000001	1		not used
2F		01	00000001	1		
30	Standard timing #6	01	00000001	1		not used
31		01	00000001	1		
32	Standard timing #7	01	00000001	1		not used
33		01	00000001	1		
34	Standard timing #8	01	00000001	1		not used
35		01	00000001	1		

Addr		Hex	Binary	Dec	Value	Description
36		9E	10011110	158	70.7	Main clock= 70.2 MHz
37		1B	00011011	27		
38		56	01010110	86	1366	Hor active=1366 pixels
39		78	01111000	120	120	Hor blanking=124 pixels
3A		50	01010000	80		4bit : 4bit
3B		00	00000000	0	768	Vertcal active=768 lines
3C		18	00011000	24	24	Vertical blanking=22 lines
3D		30	00110000	48		4bit : 4bit
3E		30	00110000	48	48	H sync. Offset=48 pixels
3F	Detailed timing/monitor descriptor #1	20	00100000	32	32	H sync. Width=32 pixels
40		25	00100101	37	2 / 5	V sync. Offset=2 lines / V sync. Width=5 lines
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		25	00100101	37	293	H image size= 293 mm(approx)
43		A5	10100101	165	165	V image size = 165 mm(approx)
44		10	00010000	16		
45		00	00000000	0		No Horizontal Border
46		00	00000000	0		No Vertical Border
47		19	00011001	25		
48		00	00000000	0		
49		00	00000000	0		
4A		00	00000000	0		Manufacturer Specified (Timing)
4B		0F	00001111	15		
4C		00	00000000	0		
4D		00	00000000	0		**Value**=HSPWmin / 2
4E		00	00000000	0		**Value**=HSPWmax / 2
4F	Detailed timing/monitor descriptor #2	00	00000000	0		**Value**=Thbpmin /2
50		00	00000000	0		**Value**=Thbpmax /2
51		00	00000000	0		**Value**=VSPWmin /2
52		00	00000000	0		**Value**=VSPWmax /2
53		00	00000000	0		**Value**=Tvbpmin / 2
54		00	00000000	0		**Value**=Tvbpmax / 2
55		1E	00011110	30		Thpmin=**value***2 + HA pixelclks
56		B4	10110100	180		Thpmax=**value***2 + HA pixelclks
57		02	00000010	2		Tvpmin=**value***2 + VA lines
58		74	01110100	116		Tvpmax=**value***2 + VA lines
59		00	00000000	0		Module revision
5A		00	00000000	0		
5B		00	00000000	0		
5C		00	00000000	0		ASCII Data String Tag
5D		FE	11111110	254		
5E		00	00000000	0		
5F		53	01010011	83	[S]	
60		41	01000001	65	[A]	
61	Detailed timing/monitor descriptor #3	4D	01001101	77	[M]	
62		53	01010011	83	[S]	
63		55	01010101	85	[U]	
64		4E	01001110	78	[N]	
65		47	01000111	71	[G]	
66		0A	00001010	10	[^]	
67		20	00100000	32	[ ]	
68		20	00100000	32	[ ]	
69		20	00100000	32	[ ]	
6A		20	00100000	32	[ ]	
6B		20	00100000	32	[ ]	

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Doc.No.	LTN133AT23-0	Rev.No	04-A01-G-120201	Page	32 / 38

6C		00	00000000	0		
6D		00	00000000	0		
6E		00	00000000	0		Monitor Name Tag (ASCII)
6F		FE	11111110	254		
70		00	00000000	0		
71		4C	01001100	76	[L]	
72		54	01010100	84	[T]	
73	Detailed timing/monitor	4E	01001110	78	[N]	
74	descriptor #4	31	00110001	49	[1]	
75		33	00110011	51	[3]	
76		33	00110011	51	[3]	
77		41	01000001	65	[A]	
78		54	01010100	84	[T]	
79		32	00110010	50	[2]	
7A		33	00110011	51	[3]	
7B		30	00110000	48	[0]	
7C		0A	00001010	10	[*]	
7D		20	00100000	32	[*]	
7E	Extension Flag	00	00000000	0		
7F	Checksum	96	10010110	150		

Approval

MTBF

* MTBF for Panel

$$MTBF = \frac{2 \times S/S \times AF \times \text{Stress Hours}}{\text{Chisq}(2r+2) @ 90\% UCL}$$

Sample Size → Acceleration Factor → Test time
r = fail size ↗ Confidence level ↗

※ Arrhenius Model : HTOL(55℃) AF=12.1
- Arrhenius equation
$AF = EXP(Ea/k * (1/Tu - 1/Ts))$
Tu : User Temp. Ts : Stress Temp.
Ea : Activation Energy
k : Boltzmann constant (= 8.617×10^{-5} eV)

※ HTOL data base.
※ Ea : Activation Energy (=0.7eV)
※ Confidence level : 60%
MTBF (Mean Time Between Failure) = 1/FR

[MTBF Simulation Result.]

Test item	Stress Temp.	Test Time	User Temp	AF	S/S	MTBF	remark
HTOL	55 ℃	500hr	25 ℃	12.1	12	31,532 hrs	-
Result	-	-	-	-	-	31,532 hrs	-

Issue Date: 2010-05-13   Page 1 of 8   Report Reference #   E164704-A110-UL
                  2010-09-07

UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2007-03-27 (Information Technology Equipment - Safety - Part 1: General Requirements) CSA C22.2 No. 60950-1-07, 2nd Edition, 2007-03 (Information Technology Equipment - Safety - Part 1: General Requirements)
Certification Type:	Information Technology Equipment Including Electrical Business Equipment
CCN:	NWGQ2, NWGQ8
Product:	Active Matrix Color TFT-LCD Module
Model:	1. LTN133AT18, LT$13#&*-***, LT$13#&*** 2. LTN133AT21, LT$13#&*-***, LT$13#&***
Rating:	1. 3.3 Vdc, 0.35 A for control circuit, 7-21 Vdc, 0.35 A for DC/DC Converter circuit.(typed TN133AT18_KKJV0.7_HF by Intersil)2. 3.3 Vdc, 0.5 A for control circuit, 7-26 Vdc, 0.5 A for DC/DC Converter circuit.(typed LTN133AT21V0.0_HF by Richtek)
Applicant Name and Address:	SAMSUNG ELECTRONICS CO LTD 200 MYEONGAM-RI TANGJEONG-MYEON ASAN- SHI CHUNGCHEONGNAM-DO 336-841 KOREA

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of Underwriters Laboratories Inc. ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability.

Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

Appendix D. Pogo Test Result

● **Model : LTN133AT23-0Substitute)**

● **Test Condition**

Class	Pressure	Plate Diameter	Total cycle	Seed	Position
LCD Panel Only	7~20kgf	10mm	10 cyc/point	Hold 2s / open 1s	Total 9 point

● **Criterion** : LCD Panel Only , Black gap (1 degree) same or under @10Kgf

● **Test Result : PASS**

Class		14Kgf	15Kgf	17Kgf	20Kgf	21Kgf	22Kgf	23Kgf	24Kgf	25Kgf	26Kgf
PANEL #1	0hr	1	2	2	2	2	2	2	2	2	2
	2hr	1	2	2	2	2	2	2	2	2	2
PANEL #2	0hr	1	1	1	1	1	1	1	2	2	2
	2hr	1	1	1	1	1	1	1	2	2	2
PANEL #3	0hr	1	1	1	1	1	1	1	2	2	2
	2hr	1	1	1	1	1	1	1	2	2	2

Doc.No.	LTN133AT23-0	Rev.No	04-A01-G-120201	Page	36 / 38

Appendix E. EE Noise Test Result

■ **Model: LTN133AT23-0(Substitute)**

■ **Date: 2011.02.23**

■ **Test Condition**

 - Time: Total 60sec, Average time 3sec

 - Frequency : 200 ~ 16,000Hz(Audio Frequency), 1/3 Octave

 - Check point: From Active center- 50cm distance / From PCB center - 4cm distance

 - Check pattern : 1Dot, White

■ **Test Result : PASS**

Pattern			LTN133AT23-0(Substitute)		
			Panel #1	Panel #2	Panel #3
1DOT	Active	All Frequency	12.7	13.6	13.0
		Audio Frequency	5.1	5.3	5.1
	PCB	All Frequency	12.4	12.6	12.0
		Audio Frequency	10.5	10.4	9.6
White	Active	All Frequency	13.1	12.7	13.1
		Audio Frequency	4.8	4.7	4.8
	PCB	All Frequency	12.3	10.8	11.8
		Audio Frequency	10.3	7.7	9.1
Backgournd Noise	Active	All Frequency	9.5		
		Audio Frequency	4.7		
	PCB	All Frequency	10.0		
		Audio Frequency	5.1		

Appendix F. Key Part List

Key Parts List

① Fill in the data of your most recent panel similar to before sample
② Paint the new parts yellow

				LTN133AT23-001		
일반 사양			MOD Line	L5 / 탕정		
			OLB Site	동화광전		
			Resolution	HD (1366*768)		
			Color Depth	45%		
			Brightness	typ 220 / min 200		
			Contrast Ratio	MIN 300		
			Viewing Angle	45/45/15/30		
			Weight(typ)	MAX 325		
			Outline	308.0 x 183.5		
			Thickness	T4.0(MAX)		
Cell	Glass		Technology	T3++ / DECA/ MB6/ Dual-ASG2		
			FAB	L5		
			Mask Number	4Mask		
		CF	Glass Maker	Corning		
			Type/Model	EXG		
			Thickness (㎜)	0.5t		
		TFT	Glass Maker	Corning		
			Type/Model	EXG		
			Thickness (㎜)	0.5t		
	Polarizer	Front	Maker	CHEIL		
			Type/Model	AMN-0246AG25		
		Surface Treatment	Coating	AG(Haze 25%)		
			Wide View Film	No		
		Rear	Maker	CHEIL		
			Type/Model	AMN-0246AG25		
	LC		Maker	Merck		
			Type/Model	Fast		
			액정/Pixel 구조	TN		
			Fill In Method	ODF		
			Response time (ms)	16ms		
			Voltage(V)	7.0V		
	Cell Gap Control		Spacer (Col./MB)	Column		
			Cell Gap			
	Drive method of inversion					
Elec	T-con		Maker	DONGBU		
			Type/Model	LUH5221N4Q-E1,NEMO		
			Voltage(V)	-		
			T-con => Source Driver IC(Inter face)	USI		
	DCDC		Maker			
	Source	PCB	Maker	TAIWAN PCB TECHVEST TRIPOD TECHNOLOGY CORPORATION N		
			Material	FR4(MIDDLE TG)		
			Layer	8L		
			PCB Rev. code	V0.0		
		Driver	Maker	DONGBU		
			Type/Model	DB7666-FS03MA		
			Number of output pin			
			Input Voltage (V)			
	Gate	Driver	Maker			
			Type/Model			
			Number of output pin			
			Input Voltage (V)			
Back Light	LED		Maker	SEM		
			Quantity.	32		
			Qty (strings x LEDs)	4*8		
			LED current (mA)	24		
			LED 광도(min)	2.1cd		
			LED assembly maker	HTR		
	LED controller		Maker	RICHTEK		
			Type/Model	QFN / RT8510GQW		
	FPC		Maker	I-PEX		
	Diffuser	Upper	Maker/Type			
		Lower	Maker/Type	CH272NH9,0.16,Printed		
	Prism sheet	Upper	Maker/Type	MAS517AST1,0.21,Tilt 148 Deg		
		Lower	Maker/Type	H505A,0.16,Tilt 58 Deg		
	Light Guide Plate		Maker/Type	DID		
			Pattern	PMMA,T0.8,Normal,Extrusion		
	Reflector Sheet		Maker/Type	DUPOCM / UX188,0.188		
	Backlight Assembly Maker			동화광전		
Others	Metal Frame(Bottom Chass		Maker	SMJNK		
			Material & Thickness	PC		
	Plastic Chassis(Frame)		Maker	SEJONG		
			Material	SGLCC		
	PCB Cover		Maker	JAEHYU		